

# LA-UR-19-28571

Approved for public release; distribution is unlimited.

Title: SOURCE CHARACTERIZATION EXERCISES

Author(s): Mcalpin, Jerry D.

Intended for: Training for Chinese Delegation at Sandia National Laboratories, Sept.

10, 2019

Issued: 2019-08-23



#### **SOURCE CHARACTERIZATION EXERCISES**

## Jerry McAlpin

#### **Source Characterization Exercise #1**

#### Question #1

A source roundup will occur in the Baotou Province to recovery unwanted sources from source owners. The radioactive sources are not documented in the national source database. What information do you need to identify the sources?

### Question #2

What other information would be useful to have prior to the recovery?

#### Question #3

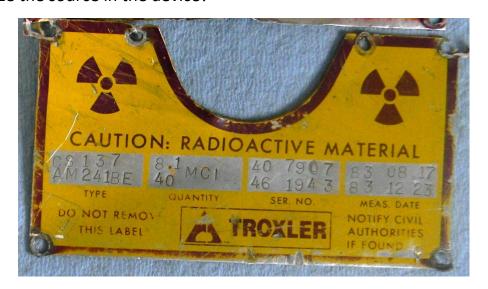
Why do we need to identify the source prior to recovery?

#### Question #4

Provide examples of things you can use to obtain this information?

### **Question #5**

One source is inside of a device that is used for identifying the moisture density in soil. The device has a tag attached, see below. What information can you use to characterize the source in the device?



## Question #1

A source owner has requested that you recover a source shown in the photo below. This is all the information that you have. Is it possible to characterize the source?

### Question #2

If the answer is yes, how would this be accomplished?

## Question #3

What are some of the issue that make characterization difficult?

## **Question #4**

What would be a last resort if characterization information is not available?



# Question #1

The source owner has requested MEE to recover a Co60 source of unknown activity. The dose rate at 1 meter is 910 mSv/hr. What is the source activity in MBq?

## Question #2

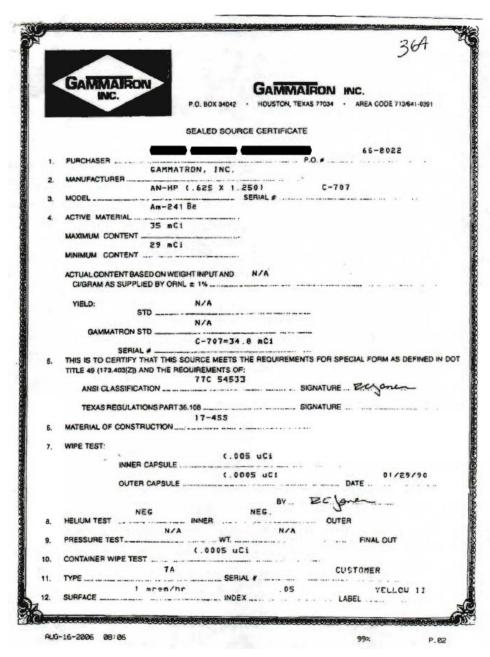
What would be the source activity at 3 meters?

## Question #3

What are some reasons we may be concerned about a 3 meter dose rate?

## Question #1

Source C-707 was recovered and the documentation below was provided.



What information would you select to fully characterize the source?

### Question #2

Is the source special form?

## Question #1

You are on a recovery team that will be responsible for characterizing the radiography source shown in the diagram below. What information does this source provide that can be used for characterization?

## Question #2

What other useful information is provided?



#### Answer #1

- 1. Physical and chemical form
- 2. Nuclide
- 3. Activity
- 4. Special Form

#### Answer #2

- Contamination results (alpha and beta)
- Dose rates (neutron and gamma)
- Manufacturer/Model of source or device
- Date of Manufacturer

#### Answer #3

The source nuclide, activity, and special form will allow the recovery team to determine the type of container needed for transport of the source and dose rates any shielding that may be required to meet transportation requirements.

#### Answer #4

- Source markings
- Device tags
- National database
- Source shipping record
- Source certificate
- Source catalog

#### **Answer #5**

Nuclide - Am241 and Cs137

Activity – 40mCi Am241 and 8.1mCi Cs137

Date of manufacture – Am241 – 12/23/83 and Cs137 – 8/17/83

#### Answer #1

Yes

#### Answer #2

- You know the source manufacturer (MRC) and isotope. With this information, you could contact the manufacturer and see if they could provide the information the needed.
- You could contact the government to determine if the source was registered.
- You could ask the source owner if they have documentation of the source (shipping paper of source certificate)
- You could see if a source catalog exist, takes source dimensions, and compare with different source models in the catalog.

#### Answer #3

- A source that is encapsulated into a lead shield with no source information visible.
- The source is located in a source holder that prevents you from determine the physical dimensions of the source.
- High dose rate source that prevent a close inspection of the source without the use of a hot cell.

#### Answer #4

Characterization through measurement

#### Answer #1

# Formula: Activity = Dose Rate / Gamma Ray Constant

910 mSv/hr =246x10<sup>4</sup> MBq

3.7X10<sup>-4</sup> mSv/hr/MBq

2.46x10<sup>6</sup> MBq

#### Answer #2

Formula:  $D_3 (r_3)^2 = D_1 (r_1)^2$ 

 $D_3 (3m)^2 = (910mSv/hr)(1)^2$ 

 $D_3 = 910/9$ 

 $D_3 = 101 \text{ mSv/hr}$ 

### Answer #3

- The dose rate to the driver of the recovery vehicle.
- The dose rate to the side of the vehicle, which could present source of radiation exposure to non-radiation workers.

## Answer #1

Am241Be, 34.8 mCi, 01/29/90

# Answer #2

Yes

### Answer #1

- Source Nuclide Ir192
- Activity 240Ci (8.9 TBq)

### Answer #2

- Type of Package Type B(U)
- Certification number for the Type B(U) package
- Type of shielding material used in the package Depleted Uranium
- Weight of the shield